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THE PLANT DISEASE REPORTER

Issued By

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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Volume XXV October 1, 1941 Number 18

IN THIS ISSUE

S. M. Zeller and A. W. Evans report the results of transmission studies with peach diseases resembling the X-disease in Oregon, page 452.

G. H. Godfrey calls special attention to certain phases of the nematode problem in emphasizing the importance of the garden survey sponsored by the Plant Nematode Council, page 453.

H. P. Barss' memorandum inviting assistance in this nematode survey is given on page 454.

Ada M. Moser's paragraph quoted on page 455 is of interest in connection with the "P.S." of Mr. Barss' memorandum.

Celery, tomato, and carrot diseases of importance observed in Oregon during September are reported by F. P. McWhorter and C. E. Owens, page 456.

Brief notes, page 457, include notes on the unusual incidence of some bean diseases in Idaho this year, by M. E. Anderson; watermelon diseases in Nacogdoches County, Texas, by Glenn KenKnight and P. A. Young; a new disease of sweet gum reported by P. P. Pirone and T. R. Bender; Ascochyta on sorghum in Mississippi; and prevention of flax rust by the use of borax.

Check list revision, by Freeman Weiss, page 459.

TRANSMISSION OF WESTERN X-DISEASE AND MARGINAL LEAF SPOT OF PEACH IN OREGON

S. M. Zeller and A. W. Evans

The X-disease, or an extremely similar disease, of peach was first recognized in eastern Oregon in 1939. It had been in some of the Oregon localities for several previous years. Its symptoms on most commercial varieties are similar to those described by Stoddard in Connecticut, and it is doubtless the same disease as that described by Thomas, Rawlins, and Parker as leaf-casting yellows in California. The distribution of the disease and its spread during the last year, as shown by surveys made in the summers of 1940 and 1941, will be reported later. We wish to report briefly at this time some results of transmission studies conducted during the seasons of 1940-1941.

Thirty-one peach seedlings grown from Lovell-peach pits were budded last autumn with buds from diseased trees in eastern Oregon. When the stocks began to grow this spring, 14 seedling trees gave definite symptoms of disease. Several of the 14 trees are now dead (August). Thirteen of the trees gave symptoms as they appear in the field, with longitudinal leaf roll and purplish bordered areas which drop out. All of the 14 trees became yellowed early, but one had flat chlorotic leaves but no leaf roll or purplish areas. Dr. E. M. Hildebrand reports to us that diseased peach buds sent from Oregon gave only this flat yellow type of disease symptom when budded into seedlings in New York. It is evident, therefore, that at least two rather distinct strains of the virus occur in the Oregon so-called X-disease.

Some buds from diseased bud sticks yielded healthy growth when budded into seedlings.

In marked contrast to the yellowed condition of Lovell seedlings with the two types of X-disease mentioned above were those to which marginal leaf spot of Rochester peach had been budded. The leaves of trees affected with this disease remain characteristically green but have few to many brownish or reddish circular spots, especially along the margins. In the Columbia River Basin of eastern Oregon, these symptoms appear in June and increase in severity through the remainder of the season. The spots drop out, leaving a ragged margin, and the leaves fall early. The fruits ripen, if any, a little late and have sound, hard pits in contrast to the brownish soft pits of fruits on trees affected with the X-disease.

This is doubtless the disease described as "Group 3" by E. L. Reeves and Lee M. Hutchins (Observations in the new so-called virus diseases of peach trees in Washington, Proc. 36th Ann. Meeting, Washington State Hort. Ass'n).

When buds from Rochester variety of peach affected by marginal leaf spot were budded into Lovell seedlings and into trees of the Rochester variety, the marginal leaf spot disease was transmitted to both. The symptoms on the budded trees were well developed after 11 months. Fifteen out of 18 of the seedling trees showed transmission while 10 out of 11 of the Rochester became infected through budding.

In this connection one of the most surprising results was obtained when buds from the red-leaved chokecherry, supposed to be infected with the western type of X-disease, were grafted into seedling peach. None of the chokecherry buds lived but in 6 cases organic union was established between the chokecherry and peach tissues. In all of the 6 cases disease transmission is very evident, but instead of the expected expression of X-disease, symptoms similar to those obtained from marginal leaf spot resulted. In inoculated trees the spots at first are circular, yellowish areas about 2 mm. in diameter. These gradually turn purplish-red, and then become necrotic brown and drop out, leaving a shot-hole effect along the margins. The central portions of the leaves have remained dark green until late in the season. Further experiments are in progress to determine the relation of this marginal leaf spot to the X-disease. If credence is to be put in the results so far obtained, either marginal leaf spot is the symptomatic expression of a distinct virus or it is a very characteristic strain of the western X-disease virus.

Another observation of two seasons indicates a definite similarity in the geographic distribution of the X-disease of peach and the green mottle mosaic of raspberry (Rubus virus 1) within Oregon. One would hardly suppose that these two viruses are related, but perhaps their insect vectors are limited to like areas.

(Oregon State College).

A PLEA FOR THE NEMATODE SURVEY

G. H. Godfrey

A recent communication from Mr. H. P. Barss, Secretary, to the Plant Nematode Council was headed "To those interested", and the subject was given as "A Root Knot Garden Poll."

As this subject has been of major interest to me for many years, I wish to express a plea for the unstinted support of the proposed activity. Not only the Nematode Council but other plant pathologists over the country also should follow the suggestions as given and attempt to determine and report losses due to nematodes in their territories.

It is my belief that the full extent of nematode damage has never been realized or adequately pictured, and that with increased knowledge on this point, better support might be obtained for nematode research in different parts of the country. Increased research is greatly needed.

One phase of the nematode problem that should have increased attention concerns the reasons for the tremendous fluctuations in nematode population from year to year, in a given field. One knows that the potential rate of increase of the organism during a single growing season would be sufficient to raise the population to immense proportions if there were not powerful factors acting against it. What constitutes the environmental resistance that prevents the potential increase in nematode population? Is it largely starvation, due to failure on the part of the nematode larvae to find root tips through which they must enter? Do unfavorable physical factors of the environment play a large part? To what extent are biological factors, that is, natural enemies, concerned? Increased knowledge along these lines may lead to practical applications that would greatly decrease the sum total of annual losses due to the widespread root-knot nematode. By judicious thought and record taking from year to year on the same fields, in connection with the proposed nematode survey, valuable information may be obtainable.

(Lower Rio Grande Valley Experiment Station, Weslaco, Texas).

The memorandum referred to by Dr. Godfrey follows:

THE PLANT NEMATODE COUNCIL

August 21, 1941

Memorandum: To Those Interested

Subject: A ROOT KNOT GARDEN POLL

The Executive Committee approved, without dissent, a proposal of Dr. E. E. Clayton that the Council sponsor a simple kind of "Gallup Poll" of home and farm gardens through the South to get some idea as to how much of a problem the root knot eelworm creates for the family that is trying to help itself and the Nation by raising food at home. The results will be used at the next plant nematode conference to be held at Memphis, February 4, 5, and 6, 1942, where plans will be laid for a program of research, education, and action to reduce root knot damage in gardens.

All are invited to participate who are willing and able to give a little time to this effort, preferably during the last of August and early September. Get anyone else who knows root knots from nodules to help if you can. Send your findings to me. I will try to digest them. Dr. H. A.

Edson has offered to make the results available to all in the Plant Disease Reporter. Random reports are desired from a wide range of country, to give well-distributed sampling. It is hoped that you can collaborate.

The Plan. 1. Visit one or more communities if you can.

2. In each community selected visit a number of farm or home gardens, new and old.

3. With the owner's help, get a rough idea of the prevalence and severity of root knot in each garden and, where bad, list the crop varieties worst affected, those less damaged, and those tolerant or resistant enough to do pretty well in spite of Heterodera marioni.

4. Send to the undersigned a simple record for each community giving: (a) the locality, (b) the number of gardens visited, (c) the number where root knot was a major problem, (d) the crop varieties worst affected therein, and (e) those most tolerant under heavy soil infestation. (Any other notes about nemas or other garden pests and diseases will be welcomed and turned over to Dr. Steiner, Dr. Edson, or others interested.)

Please mail the records on each community as soon as you get them to:

Howard P. Barss, Secretary, P.N.C.,
Office of Experiment Stations,
U.S.D.A., Washington, D. C.

P. S. In 1940, in 11 States, 645,254 farm families provided themselves with better diets by growing home gardens under the A.A.A. program. More gardens were included in 1941. How are they coming? Under National Defense the home garden has a key position and home garden problems must be given needed attention. Many believe that root knot is one of our worst garden wreckers, but we need convincing evidence as to the true situation.

HOME GARDEN FAILURES AS A FACTOR IN DIET

"One of the difficult problems all families faced was that of providing vegetable foods throughout the year. Many plantings of garden vegetables failed to produce because of unfavorable weather, lack of proper timing of planting and cultivation, failure to control blight and insect pests, use of poor seed, and other factors. Winter gardens consisted almost wholly of turnip patches, many of which failed last year. Although almost all families raised and stored sweet potatoes they frequently reported freezing and other spoilage that deprived them of this valuable food during late winter and early spring when other vegetables were scarce." -- Ada M. Moser. (Quoted from: Diet in relation to socio-economic conditions in a rural area of South Carolina. South Carolina Agr. Exp. Stat. Ann. Rep. 53:24-25. 1940.)

NOTES ON VEGETABLE DISEASES IN OREGON

F. P. McWhorter and C. E. Owens

The following vegetable diseases are of economic significance or scientific interest in Western Oregon during September 1941:

CELERY YELLOWS. Plantings of celery in the vicinity of Eugene, Oregon, where the plant is grown for "juice pack" show infection with celery yellows [virus]. The percentage of infection is low, seldom exceeding 5 percent. No definite trace of the disease was seen in adjoining carrot fields but aster plantings in near-by home gardens showed 20 percent typical western aster yellows. The western yellows has been observed also in aster plantings near Corvallis where there were no celery plantings in the vicinity. The percentage of infection in aster plantings around Corvallis averages lower than that in the plantings near the celery fields in the vicinity of Eugene.

CELERY LATE BLIGHT. Some fields of celery have been badly defoliated by Septoria infection. More than one species of Septoria seem to be present. There is some evidence that growers who dust with copper oxide are obtaining better control than those who dust with Bordeaux. Hot water seed treatments have not been tried by the local growers.

TOMATO TIP BLIGHT AND SPOTTED WILT. This virus disease was more severe than usual in southern Oregon this year. There the disease was of the spotted wilt type rather than the tip blight type. However, some typical tip blight was also present. There is some of both types in northern Oregon at this time. The distribution of the disease in northern Oregon is correlating very well with dahlias in home gardens but the source of the disease in southern Oregon has never been definitely determined.

TOMATO EARLY BLIGHT. We have observed during September the first typical outbreak of Macrosporium [Alternaria] solani infection on tomato we have seen in western Oregon. Theoretically the climate is favorable for this disease, but we have never observed it on this host. The disease developed in one commercial planting near Eugene; other fields in that vicinity were not affected. All the later forms of the disease are present. These include typical leaf spots, calyx blight, and stem and fruit infection accompanied by dropping of the fruit. There is no tendency towards the "nail head" type of fruit spot and spores of the fungus are typical of Macrosporium solani.

TOMATO LATE BLIGHT. A severe case of late blight infection (Phytopthora infestans) was noted on specimens sent in from Linn County in early September. Outbreaks have since appeared in other

western Oregon counties. This disease has been observed on tomatoes in Oregon in previous years but only occasionally and not to a serious extent.

TOMATO LEAF MOLD. The unusually wet fall has permitted at least one outbreak of Cladosporium fulvum on tomatoes growing under open field conditions. The damage is nearly as severe as that typical of occurrences on tomatoes grown in greenhouses.

CARROT CERCOSPORA SPOT. Some fields of carrots are rather badly yellowed with the leaf spot caused by Cercospora apii carotae. The growers are attributing the effect of the fungus to weather conditions, and specimens have not been sent in for diagnosis. If the disease becomes more general, control measures may have to be developed.

(Oregon Agricultural Experiment Station and Oregon State College).

BRIEF NOTES ON PLANT DISEASES

UNUSUAL INCIDENCE OF SOME BEAN DISEASES IN IDAHO: The importance of Idaho as a bean-seed-producing area depends largely upon its semi-arid climate. Many of the bean diseases commonly found in the eastern States are rarely encountered in this western area where beans are grown under irrigation. The present year, however, has brought an unusual number of rains and cloudy weather throughout the growing season.

As a result certain bean diseases, such as bean rust [Uromyces phaseoli typica] and sclerotinia rot [S. sclerotiorum] have made their appearance. Bean rust on Kentucky Wonder Beans was found quite generally during August and September. Rust was especially severe on certain fields of Great Northern beans inspected near Jerome, Idaho.

Sclerotinia rot was found sparsely in several fields in this bean-growing area. In one field at Kimberly considerable damage resulted, with complete rotting of vines and pods. Numerous well-formed sclerotia were found. (M.E. Anderson, Plant Pathologist, Rogers Bros. Seed Company, Idaho Falls, Idaho).

WATERMELON DISEASES IN NACOGDOCHES COUNTY, TEXAS: On July 23, 1941, four watermelon fields near Nacogdoches were inspected for the purpose of selecting a suitable location for fusarium wilt studies. These fields, we were informed, were representative of the conditions in this part of East Texas. In two fields of Cuban Queen the crop had failed because of fusarium wilt (F. bulbigenum niveum]. One had been replanted to Kleckley Sweet No. 6 and this variety was said to have wilted also, although at the time of our observation only a few

vines of this variety could be found and only one showed wilt symptoms. In the other wilt-infested field commercial loss from wilt exceeded 50 percent. This particular field had not been planted previously to watermelons but in the summer of 1940 it was pastured with cattle which had access to a fusarium-wilt-infested watermelon field. Among other watermelon diseases, the most prominent was Macrosporium leaf spot [Alternaria cucumerina] which caused serious defoliation in all four fields. Anthracnose [Colletotrichum lagenarium] caused spotting on occasional fruits and slight foliage injury. At least 5 percent of the fruits were rotted apparently by a species of Pythium, and a slightly higher percentage by Sclerotium rolfsii. Slight nematode injury occurred in one of the fields. (Glenn KenKnight and P. A. Young, Texas Agricultural Experiment Station).

BLEEDING NECROSIS OF SWEET GUM: P. P. Pirone and T. R. Bender describe a new disease of the sweet gum, Liquidambar styraciflua, which has been found at Roselle and Moorestown, New Jersey, and at Brighton and Great Kills, Staten Island, New York. The most striking symptom is a profuse bleeding of the bark, usually at or a few feet above the soil line, occasionally, however, as high as 20 feet; sometimes in as many as 12 distinctly separate areas on a single trunk but usually in only one or two. The inner bark of diseased trees beneath the oozing areas is dark reddish brown with an occasional pocket containing a white, crystalline-like solid. In advanced stages the sapwood is also discolored to a depth of 3 or 4 rings. Discoloration was rarely found in the heartwood. Upper portions of a diseased tree may die slowly through the season, or the entire top may die within a short time. Discoloration and bleeding is apparently confined to the above-ground portions of the tree. Trees observed to be affected varied from 8 to 75 years in age, and were mostly growing along paved streets or on landscaped property. In many cases some unfavorable environmental conditions may have been contributing factors but diseased trees were also found in situations where no detrimental factors were obvious. A fungus tentatively identified as Dothiorella berengeriana Sacc. or a closely related species, was consistently isolated from discolored bark and sapwood of diseased trees. Artificial inoculations have resulted in characteristic discoloration but not yet in bleeding. (P. P. Pirone and T. R. Bender. Bleeding necrosis of sweet gum. New Jersey Agric. Exp. Stat., Dept. Plant Path. Nursery Disease Notes 14: 4-12. Aug., Sept., 1941. Nos. 2 & 3).

ASCOCHYTA ON SORGHUM IN MISSISSIPPI: A fungus on leaves of sweet sorghum variety Honey, collected September 12 at Holly Springs, Mississippi, by E. V. Abbott of the Division of Sugar Plant Investigations, was identified by W. W. Diehl as Ascochyta sorghina Sacc. The fungus was found recently in Georgia (1936) and Alabama (1937) (PDR 21: 378, 309. 1937). This is the first report from Mississippi.

BORAX PREVENTS RUST OF FLAX: St. Paul Pioneer Press (Sept. 14): Successful treatment of flax plants with borax to prevent rust disease was announced recently by the University of Minnesota. H. G. Hegeness, of University Farm, said that plots of flax, planted in May and treated with 60 pounds of borax per acre, did not become infected with rust. Plots growing under similar conditions which were not treated were heavily rusted, as were plots on which calcium nitrate and zinc sulphate were used. Some of the flax leaves were burned by the borax, and Hegeness believes that 40 or 50 pounds instead of 60 may give the same protection and eliminate danger of burning. (U. S. Dept. of Agr. Daily Digest, September 25).

CHECK LIST REVISION

Freeman Weiss

PHORADENDRON (LORANTHACEAE).

PHORADENDRON spp., AMERICAN MISTLETOE. Woody-stemmed plants parasitic on deciduous trees, chiefly P. FLAVESCENS (Pursh) Nutt., occurring from N. J. and S. Ind. to Fla., Texas, and Calif.; used for Christmas greens. Other spp. occur in the Far West.

Asterinella phoradendri Ryan, black leaf spot. P.R.
Cuscuta exaltata Engelm., dodder, Texas.
(Diplodia phoradendri Cke.): Sphaeropsis visci
Exosporium phoradendri Tharp, leaf spot. Texas.
(Macrophoma phoradendri Wolf): Sphaeropsis visci.
Nectria cinnabarina Tode ex Fr,, twig blight. Texas.
Sphaeropsis visci (Westend.) Archer, leaf blight. S. Car., Texas.
Uredo phoradendri Jackson, rust (II), Calif., Oregon.
Valsaria phoradendri (Berk. & Curt.) Berl. & Vogl., on stems.
Volutella? weiriana Syd., on leaves. Calif.

PHOTINIA (ROSACEAE)

PHOTINIA ARBUTIFOLIA Lindl. (Heteromeles arbutifolia Roem., H. salicifolia (Presl.) Abrams), CHRISTMASBERRY, TOYON. Evergreen shrub or small tree of Growth Regions 3, 4, 5, grown for ornament and used in Christmas greens.

Cercospora heteromeles Harkn., leaf spot. Calif., Texas.
Ceuthospora brevispora Cke. & Harkn., on leaves. Calif.
Erwinia amylovora (Burr.) Winslow et al., fire blight. Calif.
Fabraea maculata Atk., leaf spot. Calif. (Sometimes distinguished as a special form but not formally described).
Fusicladium photinicola McClain, scab (leaves and berries). Calif., Texas.

PHOTINIA -- Continued.

Gymnosporangium japonicum Syd., rust (O,I). Calif. (III on Juniperus chinensis).
Hadrotrichum heteromelis Ell. & Ev., on leaves. Calif.
Lophodermium heteromelis (Phil. & Harkn.) Ell. & Ev., leaf spot. Calif.
Myriangium duriaei Mont. & Berk., on scale insects infesting bark. Calif.
Phyllosticta heteromeles Cke. & Harkn., leaf spot. Calif., Texas.
Phymatotrichum omnivorum (Shear) Dug., root rot. Texas.
Pyrenopeziza heteromeles (Phil. & Harkn.) Sacc., on leaves. Calif.
Septoria photiniae Berk. & Curt., leaf spot. Calif.

PHOTINIA spp. Evergreen shrubs or small trees of China and Japan, especially P. GLABRA (Thunb.) Maxim. and P. SERRULATA Lindl., cult. for ornament in the Far South. P. VILLOSA (Thunb.) DC., a deciduous shrub of E. Asia, also is cult. in Zone IV.

Gloeosporium sp., anthracnose, leaf spot. Miss.
Pestalotia sp., leaf spot. N. J.
Podosphaera leucotricha (Ell. & Ev.) Salm., powdery mildew. Calif.
Septoria photiniae Berk. & Curt., leaf spot. Pa.
Sphaerotheca pannosa (Wallr.) Lév., powdery mildew. Oregon.

PHYLLANTHUS (EUPHORBIACEAE)

PHYLLANTHUS spp. Tropical shrubs or small trees, some grown for ornament; P. ACIDUS (L.) Skeels, GOOSEBERRY-TREE, a native of S. Asia, is naturalized in S. Fla. and West Indies and is used for its edible fruit.

Aecidium favaceum Arth., rust (O, I). P.R.
Cercospora phyllanthae Chupp, leaf spot. P.R.
Phakopsora fenestrala Arth., rust (II,III). Canal Zone, P.R.

PHYLLODOCE (ERICACEAE)

PHYLLODOCE spp. Low evergreen shrubs of alpine and polar regions, especially the Pacific Coast, sometimes grown for ornament.

Antennaria arctica (Rostr.) Sacc. and A. rectangularis Sacc., black mold. Alaska.
Exobasidium vaccinii (Fckl.) Wor., leaf gall. Pacific Northwest.
Herpotrichia nigra Hartig, brown felt blight. Idaho.
Neopeckia coulteri (Pk.) Sacc., brown felt blight.

PHYLLOSTACHYS (GRAMINEAE, tribe BAMBUSEAE).

PHYLLOSTACHYS spp. Tall, woody grasses of E. Asia, especially P. AUREA Riv., GOLDEN BAMBOO, P. BAMBUSIOIDES Sieb. & Zucc., JAPANESE TIMBER BAMBOO and P. NIGRA MUNRO, BLACKJOINT BAMBOO; cult. in S. U.S. chiefly for ornament.

Basisporium gallarum Moll., on leaves. Fla.
Coniosporium shiraianum (Syd.) Bub., on old culms. Fla., Ga., S.Car.
Cylindrosporium bambusae Miyake & Hara, leaf spot. Ga.
Melanconium bambusae Turconi, on culms. Ga.
Puccinia melanocephala Syd., rust (II,III). Fla., Ga., Texas.
Schizophyllum commune Fr., on old culms. Fla.
Scirrhia bambusae Turconi, on old culms. Ga.
S. lophodermioides Ell. & Ev., T.H.
Ustilago shiraiana P. Henn., smut. Calif., Fla., La., Texas.

PHYSOCARPUS (ROSACEAE)

PHYSOCARPUS spp., NINEBARK. Deciduous shrubs, mostly of N. U.S.; P. OPULIFOLIUS (L.) Maxim., occurring in Growth Regions 22, 23, 24, 25, 26, 27, 28, 29, 30, is cult. for ornament, Zone 2.

(Cenangium spiraeae (Schw.) Berk.): Dermatea spiraeae?
Cercospora spiraeae Thüm., leaf spot. Ind.
Dermatea spiraeae (Schw.) Cke., on branches. N. Car., Pa.
Diaporthe eres Nit. (D. neilliae Pk.), on branches. N.Y., W.Va.
Lophiotrema spiraeae (Pk.) Sacc., on dead branches. Mich., N.Y., Pa.
Marssonina neilliae (Harkn.) Magn., leaf spot. Calif., Wis.
Pestalotia (Pestalozzia) monochaetoidea Sacc. & Ell., on dead twigs, W.Va.; and var. parasitica Dearn. & House, on leaves, N.Y., W.Va.
(Phoma spiraeae Desm.): Diaporthe eres.
Phyllosticta opulasteris Petr., leaf spot. Idaho.
Physalospora obtusa (Schw.) Cke., on branches. Va.
Ramularia spiraeae Pk., leaf spot. Mich., N.Y., Wis.
Sphaeronema physocarpi Ell. & Ev., on branches. Va.
Sphaeropsis physocarpi Ell. & Ev., on branches. W.Va. (Physalospora obtusa?)
Sphaerotheca humuli (DC.) Burr., powdery mildew. Mass. to Wis.
Stagonospora physocarpi Ell. & Ev., on twigs. W.Va.
Valsa ambiens Pers. ex Fr., and V. opulifoliae Pk., on dead branches. N.Y., W. Va.

PICEA (PINACEAE)

PICEA spp., SPRUCE. Occurring on various or undetermined spp.

PICEA -- continued.

Aleurodiscus amorphus Pers. ex Rabh., typically on dead trunks and branches, sometimes on living trees. Widespread.

Arceuthobium campylopodum Engelm. forma microcarpum (Engelm.) Gill, dwarf mistletoe, witches'-broom. N. and S. Rocky Mt. States, especially on blue and Engelmann spruces.

A. pusillum Pk., witches'-broom. Northeastern and Great Lakes States. Common on black spruce, infrequent on red and white spruces.

Armillaria mellea Vahl ex Fr., root rot. Occasional.

Ascochyta piniperda Lindau, twig blight. Me., N. Car.

Botrytis cinerea Pers., seedling blight, snow-mold. Cosmopolitan.

Cenangium ferruginosum Fr., (C. abietis Pers. ex Rehm) on twigs and cones. Colo., Me., Va.

Chrysomyxa (Melampsoropsis) cassandrae (Pk. & Clint.) Tranz. (Peridermium consimile Arth. & Kern), needle rust (O,I). New England to Great Lakes States. (II and III on Chamaedaphne calyculata (L.) Moench.)

C. ledi (Alb. & Schw.) D By. (Melampsoropsis abietina Arth., Peridermium abietinum Thüm.), needle rust (O,I). New England to Great Lakes States. II and III on Ledum spp.

C. ledicola (Pk.) Lagh. (Melampsoropsis ledicola Arth., Peridermium decolorans Pk.), needle rust (O,I). Northern U.S., Me. to Wash., and Alaska.

C. pyrolae (DC.) Rostr. (Melampsoropsis pyrolae Arth., Peridermium conorum Thüm.), cone rust (O,I). (II and III on Moneses and Pyrola spp.) New England to Great Lakes States and N. Rocky Mt. States.

Chilonectria (Nectria) cucurbitula (Curr.) Sacc., on dead branches. N.E. States.

Coniophora spp., dry rot of logs and timber. Spp. reported include C. arida (Fr.) Karst., widespread; C. corrugis Burt, sometimes on living trees, N. Rocky Mts.

Cytospora sp. and C. kunzei Sacc., canker, twig blight, especially on blue spruce. N.E. States. (Conidial stage of Valsa kunzei Fr., which is not yet reported in U.S.)

Fomes annosus (Fr.) Cke., brown root and butt rot, white spongy heart rot. New England, N. Rocky Mt. States, Pacific Coast to Alaska.

F. applanatus (Pers. ex Fr.) Gill., white mottled heart rot. Pacific N.W.

F. officinalis (Vill. ex Fr.) Faull (F. laricis (Jacq.) Murr.), brown cubical heart rot. Pacific Coast, N. Rocky Mt. States to Great Lakes.

F. pini (Brot. ex Fr.) Karst. (Trametes pini Brot. ex Fr.), red ring rot, white pocket heart rot. Widespread.

F. pinicola (Sw. ex Fr.) Cke., brown crumbly heart rot. Widespread.

F. roseus (Alb. & Schw. ex Fr.) Cke., brown cubical heart rot. New

PICEA -- continued.

England, N. Rocky Mts., Pacific N.W.
F. subroseus (Weir) Overh. (Trametes subrosea Weir), brown top rot of standing trees, brown pocket rot of timber. New England, N. Rocky Mts., Pacific N.W.
F. tenuis Karst. (Poria tenuis Schw.), on dead wood. N.Y., Pa.
Herpotrichia nigra Hartig, brown felt blight. On snow-smothered foliage. N. Rocky Mts., Pacific N.W.
Lentinus lepideus Fr., brown cubical rot of logs, stumps and timber. Cosmopolitan.
Lenzites saepiaria Wulf. ex Fr., brown sapwood rot, sometimes heart rot, of logs, timber and slash. Cosmopolitan.
L. trabea Pers. ex Fr. N.Y.
Lophodermium filiforme Darker, tar-spot needle cast. Colo., N.Y.
L. piceae (Fckl.) Höhn. New England to Great Lakes States, Pacific N.W.
Melampsorella cerastii (Pers.) Schroet. (Peridermium coloradense Arth. & Kern), rust witches'-broom. Widespread.
(Melampsoropsis spp.): See Chrysomyxa.
Neopeckia coulteri (Pk.) Sacc., brown felt blight. Colo.
Peniophora gigantea (Fr.) Mass., rot of logs, timber and slash. Widespread.
(Peridermium spp.): See Chrysomyxa and Melampsorella.
Phacidium infestans Karst., snow blight (of nursery plants). N.E. States.
Phomopsis occulta (Sacc.) Trav., twig blight, probably secondary. N.E. States. (Conidial stage of Diaporthe conorum (Desm.) Niessl).
Phytophthora cactorum (Leb. & Cohn) Schroet. and P. cinnamomi Rands, seedling blight. N.Y., Va.
Polyporus spp., wood rot, chiefly of dead standing trees, logs, stumps and slash; sometimes wound rot and heart rot of living trees. Spp. reported include P. abietinus Dicks. ex Fr., white pocket rot, widespread; P. alboluteus Ell. & Ev., white pocket rot, Great Lakes to Colo., Pacific N.W. and Alaska; P. amorphus Fr., Pa. to N. Rocky Mts., Alaska; P. anceps Pk., red-ray rot, white pocket heart rot, Pa. to N. Rocky Mts.; P. borealis Fr., white mottled heart rot, New England to N. Rocky Mts.; P. cinnabarinus Jacq. ex Fr., N.Y., N.Car.; P. circinatus Fr., butt and root rot, white pocket rot, N.Y. to Idaho; P. dryadeus Pers. ex Fr., root rot, white spongy heart rot, N. Rocky Mts.; P. fibrillosus Karst., N.Y. to N.Car., Mont., Wash.; P. fragilis Fr., N.Y. to Minn.; P. guttulatus Pk., N.Y. to Wash.; P. leucospongia Cke. & Harkn., Rocky Mt. States to Calif.; P. resinosus Schrad. ex Fr., N.Y. to Rocky Mts.; P. schweinitzii Fr., root & butt rot, brown cubical rot, widespread; P. sulphureus Bull. ex Fr., brown cubical rot, Me., Pacific N.W.; P. ursinus Lloyd, Colo., Wyo.; P. versicolor L. ex Fr., widespread; P. volvatus Pk., widespread.

PICEA -- continued.

Poria spp., typically on logs, stumps and slash; none characterized as causing economic rots of spruce. Spp. reported include P. callosa (Fr.) Sacc.= Trametes serialis; P. crustulina Bres., widespread; P. subacida (Pk.) Sacc., widespread; P. tsugina (Murr.) Sacc. & Trott.; P. vaporaria Fr., widespread; and others.
Pythium ultimum Trow., damping off. Widespread. (Reported formerly as P. debaryanum Hesse.)
Rhizoctonia solani Kühn, damping off. Cosmopolitan.
Schizophyllum commune Fr., wood rot. Occasional.
Stereum spp., typically on logs, stumps and slash. Spp. reported include: S. abietinum Pers. ex Fr., N.Y.; S. ambiguum Pk., Mont., N.Y., Tenn.; S. chailletii Pers. ex Fr., N.Y. to Wash.; S. radiatum Pk., Idaho, Mont.; S. rugisporum (Ell. & Ev.) Burt, Rocky Mts.; S. sanguinolentum Alb. & Schw. ex Fr., white pocket rot, widespread; S. sulcatum Burt, N.Car. to Rocky Mts. and Pacific N.W.
Thelephora terrestris Ehr. ex Fr. (T. laciniata Pers. ex Fr.), smothering of seedlings. Idaho, Ohio.
Trametes spp., wood rot of logs and timber. Spp. reported include: T. americana Overh. (T. odorata of American authors), widespread; T. heteromorpha (Fr.) Lloyd, N.Y. to N. Rocky Mts.; T. serialis Fr., widespread; T. variiformis Pk., N.Y., Pa.

PICEA ABIES (L.) Karst. (P. excelsa Link), NORWAY SPRUCE. Tree of C. and N. Europe, long cult. in U.S. and locally naturalized in East; numerous vars. and horticultural forms.

Ascochyta piniperda Lindau, twig blight. N.Car.
Chrysomyxa pyrolae (DC.) Rostr., cone rust (O,I). Mass.
Cylindrocladium scoparium Morgan, damping off. N.J.
Cytospora spp. (C. chrysosperma Pers. ex Fr., C. kunzei Sacc., C. leucostoma Pers. ex Sacc.), canker, twig blight. Mass. to N.J. and Ill.
Herpotrichia nigra Hartig, brown felt blight. Colo., Oregon.
Lophodermium piceae (Fckl.) Höhn., needle cast. Mass., Mich.
Melampsorella cerastii (Pers.) Schroet., rust witches'-broom (O,I). Idaho, Mont., Wash., Wyo.
Pestalotia (Pestalozzia) spp., on cones and twigs. P. funerea Desm., Mass., P. truncata Lév., N.Y.
Phoma piceina Pk., on twigs, ? needle blight. N.Y., Md., Chio
P. strobiligena Desm., on cone scales. Me., Ohio.
Phytophthora cinnamomi Rands, damping off. Va.
Sphaeropsis ellisii Sacc., collar rot. N.J.

PICEA ENGELMANNI (Parry) Engelm., ENGELMANN SPRUCE. Tree of Growth Regions 4, 9, 11, 12, 13, 14, 15; also cult., Zone II.

Arceuthobium campylopodum Engelm. forma microcarpum (Engelm.) Gill, dwarf mistletoe. Northern and Southern Rocky Mts.
Chrysomyxa cassandrae (Pk. & Clint) Tranz., needle rust (O,I). Wis.
C. ledicola (Pk.) Lagh., needle rust (O,I). Colo., Idaho.
C. pyrolae (DC.) Rostr., cone rust (O,I). Colo., Mont., Oregon.
C. weirii Jacks., needle rust (III). Mont. to Oregon and Wash.
Coniophora corrugis Burt, sapwood rot of logs or sometimes living trees. Colo., Idaho, Wyo.
Dasyscypha agassizii (Berk. & Curt.) Sacc. and D. arida (Phill.) Sacc., on twigs. Colo, Wash.
Echinodontium tinctorium (Ell.) Ell. & Ev., brown stringy heart rot. Idaho, Mont., N. Mex., Utah.
Fomes annosus (Fr.) Cke. and F. nigrolimitatus (Romell) Egeland, white pocket rot. N.Rocky Mt. States.
F. officinalis (Vill. ex Fr.) Faull, brown cubical heart rot. Widespread.
F. pini (Brot. ex Fr.) Karst., red ring rot, white pocket rot. Widespread.
F. pinicola (Sw. ex Fr.) Cke., brown crumbly rot. Widespread.
F. roseus (Alb. & Schw. ex Fr.) Cke. and F. subroseus (Weir) Overh., brown cubical heart rot. Occasional.
Fusarium scirpi Lamb. & Fautr. var. acuminatum (Ell. & Ev.) Wr., snow mold of nursery plants. Colo.
Herpotrichia nigra Hartig, brown felt blight. N. Rocky Mts., Pacific N.W.
H. quinqueseptata Weir, Colo., Idaho.
Lophodermium filiforme Darker, tar spot needle cast. Colo.
L. piceae (Fckl.) Höhn., Oregon, Wash.
Melampsorella cerastii (Pers.) Schroet., rust witches'-broom. N. and S. Rocky Mt. States.
Polyporus alboluteus Ell. & Ev., white pocket rot. Colo. to Mont. and Wash.
P. anceps Pk., red-ray rot, white pocket heart rot. Colo., N.Mex.
P. circinatus Fr., root & butt rot, white pocket rot. Idaho.
P. dryadeus Pers. ex Fr., root rot, white spongy heart rot. Colo. to Mont. and Wash.
P. schweinitzii Fr., reddish brown heart rot. N.Rocky Mts.
Rosellinia weiriana Sacc., on twigs. Wash.
Sparassis radicata Weir, root rot. Idaho, Mont., Oregon, Wash.
Trametes heteromorpha (Fr.) Lloyd, brown cubical heart rot. Colo.
T. isabellina Fr. (Fomes tenuis Karst.) white pocket heart rot. Colo., Mont.

PICEA GLAUCA (Moench) Voss (P. canadensis (L.) B.S.P.), WHITE SPRUCE. Tree of Growth Regions 12, 15, 21, 23, 24, 26, 27; also cult., Zone II. Several vars. have received distinctive names as P. G. DENSATA Bailey, BLACK HILLS SPRUCE;

PICEA -- continued.

P.G. ALBERTIANA (S.Br.) Sarg., WESTERN WHITE SPRUCE; P. G. CONICA Rehd., DWARF ALBERTA SPRUCE, and others.

Arceuthobium pusillum Pk., witches'-broom. N.E.States to Minn.

Chrysomyxa cassandrae (Pk. & Clint.) Tranz., needle rust (C,I). Minn., Wis.

C. chiogenis Diet., needle rust (O,I). (Not yet collected on spruce but shown by inoculation to produce aecia on P. glauca and P. mariana; II and III on Chiogenes hispidula (L.) T. & G., in N.Y. and Wis.

C. empetri (Pers.) Schroet., needle rust (O,I). (Not collected on spruce in U.S. but the II stage occurs on Empetrum nigrum in N. Y. to Me.)

C. ledicola (Pk.) Lagh., needle rust (O,I). Alaska, Minn.

C. pyrolae (DC.) Rostr., cone rust (O,I). Me., Mich.

Cytospora kunzei Sacc., twig blight. Mass., N.J.

Fomes officinalis (Vill. ex Fr.) Faull, brown trunk rot. Minn., S.Dak.

F. pini (Brot. ex Fr.) Karst., red ring rot. Widespread.

F. pinicola (Sw. ex Fr.) Cke., brown crumbly rot. Widespread.

F. roseus (Alb. & Schw. ex Fr.) Cke. and F. subroseus (Weir) Overh., brown cubical heart rot. Widespread.

Lophodermium piceae (Fckl.) Höhn., tar spot needle cast. Mich.

Melampsorella cerastii (Pers.) Schroet., rust witches'-broom. Northern U.S. to Alaska.

(Peridermium). See Chrysomyxa, Melampsorella, Pucciniastrum.

Phacidium infestans Karst., snow blight. N.E.States.

Polyporus circinatus Fr., white pocket root & heart rot. Minn.

P. guttulatus Pk., root & butt rot. Minn.

P. schweinitzii Fr., root & butt rot. Widespread.

Pucciniastrum americanum (Farl.) Arth., needle rust (O,I). Not collected on spruce in U.S. but known in II and III stages on Rubus spp.

P. arcticum (Lagh.) Tranz. (Peridermium ingenuum Arth.) needle rust (C,I). New England to S.Dak. (II and III on Rubus spp.)

PICEA MARIANA (Mill.) B.S.P., BLACK SPRUCE. Tree of Growth Regions 23, 24, 26, 27; cult. Zone II; several hort. forms.

Arceuthobium pusillum Pk., witches'-broom. New England to Great Lakes.

Chrysomyxa cassandrae (Pk. & Clint.) Tranz., needle rust (O,I). N.Y. to Minn.

C. chiogenis Diet., needle rust. (Only II and III stages on Chiogenes hispidula reported in U.S.)

C. ledi (Alb. & Schw.) DBy., needle rust (O,I). New England to Great Lakes.

C. ledicola (Pk.) Lagh., needle rust (O,I). New England to Great Lakes.

C. pyrolae (DC.) Rostr., cone rust (C,I). Alaska, Me., N.H., Pa.

PICEA -- continued.

Dasyscypha agassizii (Berk. & Curt.) Sacc. and D. calycina Fckl., on dead branches. Mich., N.Y.
Fomes officinalis (Vill. ex Fr.) Faull, brown trunk rot. Minn.
F. pini (Brot. ex Fr.) Karst., white pocket rot. Widespread.
F. pinicola (Sw. ex Fr.) Cke., brown crumbly rot. Widespread.
F. subroseus (Weir) Overh., brown cubical heart rot. New England.
Lophodermium piceae (Fckl.) Höhn., tar spot needle cast. Me.
Melampsorella cerastii (Pers.) Schroet., rust witches'-broom. Me., Mich., Wis.
Phacidium expansum Davis, on twigs. Wis.
P. infestans Karst., snow blight. N.E.States.
Polyporus circinatus Fr., white pocket root and heart rot. Minn.
P. schweinitzii Fr., root & butt rot, heart rot. Minn.

PICEA PUNGENS Engelm., BLUE SPRUCE, COLORADO SPRUCE. Tree of Growth Regions 9, 12, 13, 14; also cult. in several hort. forms, Zone II.

Arceuthobium campylopodum Engelm. forma microcarpum (Engelm.) Gill, witches'-broom. N.Mex.
A. pusillum Pk., Me.
Ascochyta piniperda Lindau, twig blight. Me.
Chrysomyxa cassandrae (Pk. & Clint.) Tranz., needle rust (0,I). Minn., N.H., Wis.
C. ledi (Alb. & Schw.) DBy., needle rust (0,I). Minn.
C. ledicola (Pk.) Lagh., needle rust (0,I). Me., Minn., N.Y.
Cytospora kunzei Sacc., canker, twig blight. N.E.States to Ill. and Minn.
Dasyscypha oblongospora Hahn & Ayers, on twigs. Mass., Pa.
Fomes pini (Brot. exFr.) Karst., white pocket heart rot. Colo.
F. pinicola (Sw. ex Fr.) Cke., brown cubical heart rot. Colo.
Herpotrichia nigra Hartig, brown felt blight. Mont.
Lophodermium piceae (Fckl.) Höhn., tar spot needle cast. Mich.
Melampsorella cerastii (Pers.) Schroet., rust witches'-broom (0,I). Mont. and S.Dak. to N. Mex.
Phomopsis occulta (Sacc.) Trav., on twigs. N.J.
Phytophthora cinnamomi Rands, root rot (seedlings). Md.
Rhizosphaera kalkhoffii Bubak, leaf cast. Conn. N.Y.
Sphaeropsis ellisii Sacc., twig blight, collar rot.

PICEA RUBRA Link (P. rubens Sarg.), RED SPRUCE. Tree of Growth Region 27; also cult. Zone II.

Chrysomyxa cassandrae (Pk. & Clint.) Tranz., needle rust (0,I). Mich., N.Y.
C. empetri (Pers.) Schroet., needle rust 0,I. (Only II stage on Empetrum nigrum reported in U.S.)

PICEA -- continued.

C. ledicola (Pk.) Lagh., needle rust (O,I). N.H., N.Y.
C. pyrolae (DC.) Rostr., cone rust (O,I). Me., N.Y., Pa., Vt.
C. roanensis Arth., needle rust (O,I). N.Car., Tenn. (II and III on Rhododendron catawbiense.)
C. weirii Jack., needle rust (III.) Tenn., W.Va.
Cytospora kunzei Sacc., twig blight. N.Y.
Desyscypha spp. (D. abietis (Karst.) Sacc. and D. agassizii (Berk. & Curt.) Sacc.), on twigs. N.Y., Vt.
Fomes annosus (Fr.) Cke., butt rot, white spongy heart rot. Me., Vt.
F. pini (Brot. ex Fr.) Karst., red ring rot. N.E.States, N.Car.
F. pinicola (Sw. ex Fr.) Cke., brown sapwood rot. New England, Tenn.
F. roseus (Alb. & Schw. ex Fr.) Cke. and F. subroseus (Weir) Overh., brown heart rot. N.E. States.
Lophodermium filiforme Darker and L. piceae (Fckl.) Höhn., tar spot needle cast. N.Y.
Melampsorella cerastii (Pers.) Schroet., rust witches'-broom. Me., N.Y.
Phacidium infestans Karst., snow blight. N.E. States.
Phoma piceina Pk., on needles. N.Y.
Phragmotrichum chaillettii Kze., on cones. N.Y., N.Car.
Polyporus spp., wood rot of logs and timber, or sometimes living trees. Spp. reported include: P. abietinus Dicks. ex Fr.; P. anceps Pk., N.H., Vt.; P. alboluteus Ell. & Ev., N.Y.; P. borealis Fr., N.Y., Tenn.; P. schweinitzii Fr., N.Y., Vt.; P. sulphureus Bull. ex Fr., Me.; P. versicolor L. ex Fr., widespread.
Trametes serialis Fr. and T. variiformis Pk., rot of logs and timber. N.E. States.

PICEA SITCHENSIS (Bong.) Carr., SITKA SPRUCE. Tree of Growth Region 1; also cult. in western part of Zone VI.

Aleurodiscus amorphus Pers. ex Rabh. and A. subcruentatus (Berk. & Curt.) Burt, on branches and trunks, sometimes of living trees. Calif., Oregon.
Armillaria mellea Vahl ex Fr., root rot. Wash.
Chrysomyxa ledicola (Pk.) Lagh., needle rust (O,I). Alaska, Wash.
C. piperiana (Arth.) Sacc. & Trott. (Peridermium parksianum Faull), needle rust (O,I). Calif., Oregon. (II and III on Rhododendron californicum Hook.)
Fomes annosus (Fr.) Cke., root & butt rot, white spongy heart rot. Alaska, Calif., Wash.
F. applanatus (Pers. ex Fr.) Gill., white mottled heart rot. Wash.
F. officinalis (Vill. ex Fr.) Faull, brown trunk rot. Wash.
F. pini (Brot. ex Fr.) Karst., white pocket heart rot. Calif. to Alaska.
F. pinicola (Sw. ex Fr.) Cke., brown cubical heart rot.
F. roseus Alb. & Schw. ex Fr. and F. subroseus (Weir) Overh. brown cubical heart rot. Pacific N.W.

PICEA -- continued.

Ganoderma oregonense Murr., rot of logs & stumps. Oregon.
Lenzites saepiaria Wulf. ex Fr., sapwood rot of logs & slash. Pacific N.W.
Lophodermina septata Tehon, tar spot needle cast. Oregon.
Lophodermium piceae (Fckl.) Höhn., needle cast. Alaska, Calif., Oreg.
Melampsorella cerastii (Pers.) Schroet., rust witches'-broom. Alaska, Wash.
Polyporus abietinus Dicks. ex Fr., P. alboluteus Ell. & Ev., P. fibrillosus Karst., and P. versicolor L. ex Fr., sapwood rot of logs and down trees. Pacific N.W.
P. berkeleyi Fr., root & butt rot. Calif.
P. schweinitzii Fr., root & butt rot. Calif., Oregon, Wash.
Rosellinia thelena (Fr.) Rabh., on branches. Alaska.
Trametes heteromorpha (Fr.) Lloyd and T. serialis Fr., brown pocket rot of logs & timber. Pacific N.W.

(Division of Mycology and Disease Survey).